We Claim:

1. A method for forming a high optical confinement waveguide structure, the method comprising the step of:

- forming a silicon-based waveguide on a substrate by depositing a waveguide layer of silicon containing material onto the substrate;

wherein the material is selected in a manner such that the refractive index of the waveguide is greater than the refractive index of the substrate.

2. A method as claimed in claim 1, further comprising the step of depositing a first layer of a first material on a wafer to form the substrate prior to depositing the waveguide layer.

3. A method as claimed in claim 2, wherein the wafer comprises a silicon wafer.

4. A method as claimed in claim 2, wherein the first layer is silica-based.

5. A method as claimed in claim 1, wherein the forming of the silicon-based waveguide further comprises etching the deposited waveguide layer.

6. A method as claimed in claim 5, wherein the etching is performed in a manner such as to form a ridge structure in the deposited waveguide layer.

7. A method as claimed in claim 1, wherein the method further comprises the step of depositing a second layer of a second material to form an etch-stop during the etching of the ridge structure.

8. A method as claimed in claim 1, wherein the method further comprises the step of varying the refractive index in the deposited waveguide layer to form a refractive index profile in the waveguide.

9. A method as claimed in claim 8, wherein the step of varying the refractive index comprises exposing the deposited waveguide layer to radiation to induce refractive index changes in the deposited waveguide layer.

10. A method as claimed in claim 1, wherein the silicon containing material comprises a dopant material.

11. A method as claimed in claim 1, wherein the silicon containing material is selected in a manner such that the deposited waveguide layer comprises amorphous silicon.

12. A method as claimed in claim 11, wherein the silicon containing material is selected in a manner such that the deposited waveguide layer comprises amorphous silicon and oxidized silicon.

13. A method as claimed in claim 1, wherein the method further comprises crystallising the deposited waveguide layer and forming the waveguide in the polycrystalline waveguide layer.

14. A method as claimed in claim 13, wherein the step of cystallising comprises utilising a dopant incorporated into the waveguide during the deposition of the waveguide layer in the silicon containing material to control a grain size in the crystallised waveguide.

15. A method as claimed in claim 1, wherein the step of forming the waveguide comprises plasma enhanced chemical vapour deposition (PECVD).

16. A method as claimed in claim 1, wherein the step of forming the waveguide comprises forming a taper in an end portion of the deposited waveguide for optical coupling to an optical fibre.

17. A method as claimed in claim 16, wherein the step of forming the taper comprises varying the refractive index of the deposited waveguide layer in the end portion of the waveguide.

18. A method as claimed in claim 17, wherein the varying of the refractive index in the end portion comprises controlled oxidation of the deposited waveguide layer.

19. A method as claimed in claim 18, wherein the controlled oxidation comprises a laser to heat the deposited waveguide layer.

20. A method as claimed in claim 19, wherein the laser comprises a CO_2 laser.

21. A method as claimed in claim 1, wherein the method further comprises the step of forming an optical signal processing element in and integrated with the deposited waveguide layer.

22. A method as claimed in claim 22, wherein the processing element comprises a photodetector incorporating a dopant material in the silicon-based waveguide structure.

23. A method as claimed in claim 22, wherein the processing element is arranged to be controlled electrically to change its refractive index.

24. A method of coupling a silicon-based waveguide to an optical fibre, the method comprising the steps of:

- oxidizing the silicon-based waveguide in an end portion thereof, the end portion being, in use, located adjacent an end phase of the optical fibre for optical coupling;

wherein the oxidizing is controlled in a manner such that a refractive index profile is created in the end portion, and wherein the refractive index is altered in a manner such that it substantially matches that of the optical fibre at an outer end of the end portion.

25. An optical device incorporating a silicon-based waveguide structure on a substrate formed on a substrate, the device comprising a processing element formed and integrated with the silicon-based waveguide structure.